MAUNAWILI ESTATES
PRELIMINARY SOIL REPORT

KAMAKALEPO, KAILUA, KOOLAUPOKO, OAHU, HAWAII
TAX MAP KEY: 4-2-62: POR. of 26

To:
PARK ENGINEERING, INCORPORATED

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

MARCH 12, 1973

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

WALTER LUM
EDWARD WATANABE
EZRA KOIKE
WALLACE WAKAHIRO
3030 WAIALAE AVE., HONOLULU, HAWAII 96816 • TEL. 737-7931

March 12, 1973

PARK ENGINEERING, INC.
1149 Bethel Street, Room 710
Honolulu, Hawaii 96813

Gentlemen:

Subject: Maunawili Estates
Preliminary Soil Report
(for residential development)
Kamakalepo, Kailua, Koolaupoko, Oahu, Hawaii
Tax Map Key: 4-2-62: Por. of 26

Transmitted herewith is our preliminary soil exploration report for residential development purposes for the proposed Maunawili Estates at Kamakalepo, Kailua, Koolaupoko, Oahu, Hawaii.

For site developments, the site grading will involve cutting of the hills to fill over natural drainageways. The natural channels should be carefully subdrained before filling. Some settlements of the fills are to be anticipated.

This report includes a Boring Location Sketch, boring logs, laboratory test results, recommendations and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

By Ezra Koike
Ezra Koike

CM/EK:rmf

C O N T E N T S

MAUNAWILI ESTATES
PRELIMINARY SOIL REPORT

KAMAKALEPO, KAILUA, KOOLAUPOKO, OAHU, HAWAII
TAX MAP KEY: 4-2-62: POR. of 26

SCOPE OF EXPLORATION

The purpose of this exploration was to determine general soil conditions for residential development for the proposed Maunawili Estates.

This report includes field explorations, laboratory tests, general recommendations and limitations.

FIELD EXPLORATION AND LABORATORY TESTS

Five exploratory borings were made at the approximate locations shown on the Boring Location Sketch. Borings were made with 3-in. diameter augers using a carbide drag bit. Soil samples were recovered with 2-in. diameter thin wall tube and 2-in. standard split spoon samplers driven with a 140-lb hammer falling 30 inches.

Laboratory tests included: natural water content, unconfined compression, Atterberg limit, grain-size analysis, specific gravity, AASHO T-180-57 density, expansion and CBR.

A summary of the laboratory test results is given in Tables IA and IB.

GEOLOGIC AND SOIL DESCRIPTIONS BY OTHERS

Stearns, "Geologic and Topographic Map, Island of Oahu, USGS 1938":

Qa - consolidated deposits, chiefly older alluvium.

U. S. Soil Conservation Service, "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii," August, 1972:

p. 131: Waikane silty clay, 40 to 70 percent slopes (WpF2) MH.

Land Use Study Bureau, "Oahu Lands Classified by Physical Qualities for Urban Use":

I4L

SOIL CLASSIFICATION SYSTEM

Soil samples were visually observed and subjected to appropriate tests in the laboratory. Based on visual observations and laboratory tests, the soil descriptions given on the boring logs are generally made in accordance with the "Unified Soil Classification System."

GENERAL SITE CONDITIONS

Site Location

The project site is located at the end of Kika Street in Kamakalepo, Kailua, Koolaupoko, Oahu, Hawaii.

Annual Rainfall

The average annual rainfall varies from about 50 to 75 inches.

Topography

Three gullies, with depths varying from about 20 to 30 ft, cross the site making the over-all topography very hilly. The gullies generally drain to the east. The gullies were dry during the field exploration. Slopes in the area vary from about 5 to 50% and steeper in localized areas.

There are grass cover and trees over most of the site. The southern portion of the site, west of Kika Street, was bare.

Houses border the site to the south while the area bordering the north side is undeveloped.

INTERPRETATION OF SOIL CONDITIONS

From the field exploration and laboratory test results, the soils may be generally approximated as follows:

Medium to stiff clayey silt with decomposed rock to 21.5 ft, the depths drilled.

Water was not noted in the borings during the field explorations.

Variations to the above soil conditions are to be expected in localized areas. For more detailed descriptions of soils encountered in the drill holes, refer to the boring logs.

DISCUSSION AND RECOMMENDATIONS

In general, the proposed plan is to clear and grade the site for residential development. The hills will be cut to fill the gullies.

Cuts of up to 25 ft are contemplated on the eastern side of the site. Fills of up to 22 ft are contemplated over the gullies.

Before the construction of fills over drainageways, the natural channels should be drained and subdrains installed. Storm drainage systems should be carefully designed to intercept and channelize the flow that formerly followed the natural gullies.

Some settlement of the fills over the drainageways may be anticipated. Settlement gages should be installed to monitor the performance of fills. After allowing the ground to consolidate for as long as practicable or when settlement gages show negligible rates of settlements, building construction may proceed over the compacted fill.

The preliminary plans indicate that a 10-ft high retaining wall is contemplated in a natural drainage gully on the eastern side of the

site. Clearing and grubbing, and subdraining the gully and the foundation preparation for the walls should be made with care.

Site Grading

In general, the on-site soils may be used for the construction of the proposed fills. The grading of the site, particularly the construction of fills, should be done prior to building construction to allow the underlying soils as much time as practicable to adjust to the new load experience.

Grading work should be done in accordance with the requirements of Chapter 23, Revised Ordinances of Honolulu, 1969 As Amended; and as recommended below:

1. The area should be cleared and grubbed. Surface vegetation and miscellaneous debris should be cleared and removed prior to site filling.

2. Loose surface soils should be stripped to stiff natural ground before the placement of fills. Loose surface soils at finish grade should be scarified and recompacted.

3. Where fills are proposed on sidehill areas, gullies and natural drainageways, loose material at the bottom and sides should be stripped down to stiff natural ground before the placement of fills.

Subdrains should be placed along the bottom of natural drainageways with laterals in a herringbone pattern along the sides of the drainageways.

4. Localized soft pockets encountered during the site preparation should be excavated and replaced with compacted select material.

5. Thin sidehill fills (sliver fills) on sloping areas should be avoided, if practicable. Otherwise, a blanket of granular material should be placed along the toe of slope (Figure 1). ?

6. Fills should be constructed in approximately level layers starting at the lower end and working upward. Where fills are made on sloping areas steeper than about 5 horizontal to 1 vertical, the ground at the toe of the fill should be benched to a generally level condition. As the fill is brought up, it should continually be keyed into stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.

7. Where practicable, fills should be laid in 6-in. compacted layers to 90% of the maximum density

determined by the AASHO T-180-57 test method, otherwise the density will have to be adjusted in the field in accordance with the recommendations of a soils engineer.

8. The on-site soils from the deeper cut areas with relatively high water contents may be difficult to compact.

   When used for the construction of fills, these soils should be compacted in one-foot layers to the maximum density obtainable in the laboratory at the water content approximating the field moisture condition. In addition, the relative density of the compacted soil should be greater than 85% of AASHO Test No. T-180-57. 70

   — Prior approval should be specified based on evaluation of variation of moisture content w/ expansion and CBR

9. Provisions should be included to drain the site during and after filling operations.

Slopes

In general, cut and fill slopes of 2 horizontal to 1 vertical or flatter should be used.

For slope heights (top to toe) greater than 20 ft, 8-ft-wide benches should be placed at height intervals of about 15 ft.

To minimize erosion, the runoff from rainstorms should be diverted away from slopes by berms or ditches whenever practicable.

The surface of fill slopes should be compacted by cat-tracking or with a sheepsfoot roller.

Slope planting is recommended on cut and fill slopes to minimize erosion.

Slope adjustments or other precautions may be necessary if seepage zones, expansive clay pockets or soft spots are encountered in localized areas.

Foundations

General recommendations for foundation design are as follows:

1. For light, short-span residential structures, post and beam type foundations may be considered depending on the design grading of the site. If slab on ground is considered, the construction should be delayed as long as practicable until settlement gages indicate negligible rates of settlements.

2. Bearing values for a given soil usually vary with size and depth of footings. For light

residential structures, bearing values of about 1500 p.s.f. may be used for footings on stiff natural ground or on compacted fill.

3. Soft spots or pockets of loose material encountered in footing excavations or below the building area should be excavated and replaced with well-graded granular material such as coral or other approved material.

4. Concrete slabs on ground should be placed over a base course of 4 in. of well-graded gravel less than 3/4-in. in size. The subgrade should be compacted and shaped to a level surface or to drain, if practicable, and generally should be kept slightly higher than the finish grade.

5. Because of the downhill creep effect of soils on a slope, some settlements may occur near the tops of slopes. Slab-on-ground buildings should generally be placed about 15 ft from the tops of slopes. This distance may be reduced for lower slope heights, e.g., 10 ft for 10-ft-high slopes, but generally not closer than 5 ft from the top of a slope.

6. Because of possible creep, erosion, and local sloughing of sloping ground, short small diameter pile foundations are recommended for those structures that are constructed on lots graded steeper than 5 horizontal to 1 vertical.

7. Several units may be partly on cut and partly on fill. To minimize the differential settlements that may occur, the cut area below the unit should be excavated to a depth of about 3 ft and recompacted to match the density of the fill area.

8. Construction of retaining walls on slopes should generally be avoided.

9. Good surface drainage away from the foundations of structures should be maintained and the site should be graded to prevent the ponding of water.

Retaining Walls

Retaining walls should generally be avoided on sloping ground.

The proposed retaining wall at the northeast corner of the site appears to be situated over ground that slopes at about 3:1 or

2:1. This wall should be avoided or carefully designed with regard to the ground sloping down from the toe of slope. The retaining wall should be designed to resist soil pressures equal to at-rest conditions or an equivalent fluid pressure of about 40 p.c.f. The center of pressure should be considered to act somewhat above the lower third of the triangular fluid pressure diagram, assuming that subdrainage and drainage of the backfill are provided. The foundation of the wall should be carried down well into the stiff natural ground. Field adjustments may be necessary.

A buttress fill of well-graded granular material may be considered in lieu of a wall.

Roadway and Parking Area

In general, for light automobile traffic and drained subgrade conditions, an estimate of roadway and parking area pavement thickness is as follows:

1. Wearing course - 2-in. asphaltic concrete.
2. Base course - 6-in. base course.
3. Subbase course - 6-in. select material over a prepared subgrade.

Provisions should be made in the contract documents to allow for local adjustments regarding select borrow subbase and

borrow material requirements in the field in accordance with the design standards of the City and County of Honolulu. In fill areas, the use of select soils within the top 2 to 3 ft of the subgrade may reduce the thickness of or eliminate the need for the select borrow subbase or borrow courses.

The subgrade should be compacted and shaped to drain. To avoid the ponding of water and softening of the subgrade at low points, weep holes should be placed at subgrade levels thru the walls of the catch basins which are placed in these low areas.

Utilities

Utilities should be placed after the fills are constructed. Utility lines should be designed with flexible joints, particularly where lines are connected to structures.

Unforeseen Conditions

Unforeseen or undetected conditions such as soft spots, seepage water or expansive soil pockets may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.

Site Regrading

After mass grading work is done and cuts and fills are made according to the grading plans, regrading at some future date should be avoided unless done under the guidance of a Soils Engineer.

PROPOSED SPECIFICATION FOR EARTHWORK

MAUNAWILI ESTATES

General Description

This item shall consist of clearing and grubbing, preparing of land to be filled, excavating and filling of the land, spreading, compacting and testing of the fill, and subsidiary work necessary for grading the site.

Clearing, Grubbing and Preparing Areas to be Filled

Vegetation, rubbish and miscellaneous material shall be removed and disposed of, leaving the disturbed area with a neat, debris-free appearance.

Loose surface soils shall be stripped to stiff natural ground before the placement of fills. Loose surface soils encountered at finish grade shall be scarified and recompacted.

The bottom and sides of gullies or natural drainageways shall be stripped down to stiff natural ground before the placement of fills.

Trenches shall be cut in a herringbone pattern and subdrains placed in the trenches to provide drainage paths for the bottom of the drainageway.

Materials

Fill material shall consist of selected on-site soils or approved borrow soils. The soils shall contain no more than a trace of organic and deleterious matter.

Borrow soils shall be select soils generally less than 3-in. maximum size, with more than 30% fines and a plasticity index generally less than 20.

Fill material placed in the top 2 ft of fills shall contain less than 30% gravel.

Placing, Spreading and Compacting Fill Material

The selected fill material shall be placed in level layers which, when compacted, shall not exceed 6 inches. Each layer shall be spread evenly and thoroughly blade-mixed during the spreading to attain uniformity of material and water content within each layer.

Rocks or cobbles shall not be allowed to nest and voids between rocks shall be carefully filled and compacted with small stones or earth.

When the water content of the fill material is well below the optimum for compacting purposes, water shall be added until the water content is near optimum.

When the water content of the material is well above the optimum for compacting purposes, the fill material shall be aerated by blading or by other satisfactory methods until the water content is near the optimum.

After each layer has been placed, mixed and spread evenly, it shall be compacted to 90% of maximum density in accordance with AASHO Test No. T-180-57 or other comparable density tests. Compaction shall be with sheepsfoot rollers, mutiple-wheel pneumatic-tired rollers or other acceptable rollers which shall be able to compact the fill to the

specified density. Rolling shall be accomplished while the fill material is at the specified water content. The rolling of each layer shall be continuous over its entire area and the roller shall make sufficient passes to obtain the desired density.

Field density tests shall be made to get an indication of the compaction of the fill. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density readings shall be taken as often as necessary in the compacted material below the disturbed surface. When these readings indicate that the density of any layer of fill or portion thereof is below the required 90% density, that layer or portion shall be reworked until the required density has been obtained.

The fill operation shall be continued in 6-in. compacted layers, as specified above, until the fill has been brought to the finished slopes and grades as shown on the accepted plans.

Compaction of High Moisture Fill Material

The on-site soils from the deeper cut areas with relatively high water contents will be difficult to compact.

When used for the construction of fills, these soils shall be compacted in one-foot layers to the maximum density obtainable in the laboratory at the water content approximating the field moisture condition. In addition, the relative density of the compacted soil shall be greater than 85% of AASHO Test No. T-180-57.

Excavation

Suitable material from excavation shall be used in the fill and unsuitable material from excavation shall be disposed of.

Unforeseen Conditions

If unforeseen or undetected critical soil conditions such as soft spots, seepage water or expansive soil pockets are encountered, corrective measures shall be made in the field as they are detected.

Rainy Weather

Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests indicate that the water content and density are as previously specified.

BORING LOGS

The stratification lines shown on each of the boring logs represent the approximate boundary between soil types and the transition may be gradual.

Symbols

Symbols used generally are in accordance with the Unified Soil Classification System.

Where a parenthesis "(MH)" is used, the soil sample was classified by visual observation of the sample recovered.

Where no parenthesis "MH" is used, the soil sample was classified from either the Atterberg limit or sieve analysis test results.

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: MAUNAWILI ESTATES
LOCATION: Kailua, Koolaupoko, Oahu, Hawaii
Tax Map key: 4-2-62: Por. of 26

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" SS. 2" O.D. THIN WALL TUBE
2" SS. 2" STANDARD SPLIT SPOON

BORING NO. 1 Sheet No. ____ of ____
Driller: W. LUM ASSOC., INC. Date: FEB. 21, 1973
Field Party: MEYER, KAKU, OSHIRO
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 168'± * Datum: —
Drill Bit: T.C. DRAG
Water Level: NOT NOTICED
Time: —
Date: 2-21-73

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 168'± *	0									
(MH)	MEDIUM, BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK & ROOTS		2"S	1-A	104	45	72	6040	—		5/0.5 4/0.5 4/0.5
		5	2"SS	1-B	—	51	—	—	—		
		10	2"S	1-C	102	53	66	5040	—		4/0.5 5/0.5 7/0.5
MH	STIFF, MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK					LL = 79 PL = 61					
		15	2"SS	1-D	—	57	—	—	—		
		20	2"S	1-E	104	64	63	—	—		5/0.5 5/0.5 7/0.5
	END OF BORING @ 21.5'										
	* ELEVATION ESTIMATED FROM TOPO MAP										

MAUNAWILI ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: MAUNAWILI ESTATES
LOCATION: Kailua, Koolaupoko, Oahu, Hawaii
Tax Map Key: 4-2-62: Por. of 26

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2"SS. 2"O.D. THIN WALL TUBE
2"SS. 2" STANDARD SPLIT SPOON

BORING NO. 2 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date FEB. 22, 1973
Field Party MEYER, OSHIRO, KAU
Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"
Elev. 195'± * Datum —
Drill Bit T.C. DRAG
Water Level NOT NOTICED
Time —
Date 2-22-73

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2"O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 195'± *	0									
(MH)	STIFF, BROWN CLAYEY SILT		2"S	2-A	108	50	72	6950	-		7/0.5' 8/0.5'
(MH)	STIFF RED & LIGHT BROWN CLAYEY SILT	5	2"SS	2-B	-	61 53	-	-	-		
MH	STIFF, BROWN CLAYEY SILT W/SOME DECOMPOSED ROCK					LL=90 PL=56					
(MH)	MEDIUM TO STIFF MOTTLED BROWN & RED CLAYEY SILT	10	2"S	2-C	106	50	71	2120	-		4/0.5' 5/0.5' 9/0.5'
(MH)	MEDIUM MOTTLED LIGHT BROWN CLAYEY SILT	15	2"SS	2-D	-	65	-	-	-		
(MH)	RED & BROWN CLAYEY SILT W/DECOMPOSED ROCK	20	2"SS	2-E	-	41	-	-	-		23/0.5'
	END OF BORING @ 21'										

* ELEVATION ESTIMATED FROM TOPO MAP

MAUNAWILI ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: MAUNAWILI ESTATES
LOCATION: Kailua, Koolaupoko, Oahu, Hawaii
Tax Map Key: 4-2-62: Por. of 26

BORING NO. 3 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date FEB. 22, 1973
Field Party MEYER, OSHIRO, KAU
Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"
Elev. 224'± * Datum —
Drill Bit T.C. DRAG

HAMMER:
Weight 140#
Drop 30"
SAMPLER: 2" S.S. 2" O.D. THIN WALL TUBE
2" SS. 2" STANDARD SPLIT SPOON

Water Level				
Time				
Date	2-22-73			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 224'±↓ 0 *										
(MH)	STIFF, MOTTLED BROWN CLAYEY SILT		2"S	3-A	103	41	73	12,350	—		5/0.5' 6/0.5' 7/0.5'
(MH)	STIFF, BROWN CLAYEY SILT	5	2"SS	3-B	—	40	—	—	—		
		10	2"S	3-C	113	43	79	8590	—		4/0.5' 10/0.5'
MH	STIFF, REDDISH BROWN SILTY CLAY					LL=108 PL=55					
		15	2"SS	3-D	—	49	—	—	—		
(MH)	STIFF MOTTLED BROWN CLAYEY SILT	20	2"S	3-E	106	55	69	2970	—		5/0.5' 6/0.5' 8/0.5'
	END OF BORING @ 21.5'										

* ELEVATION ESTIMATED FROM TOPO MAP

MAUNAWILI ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: MAUNAWILI ESTATES
LOCATION: Kailua, Koolaupoko, Oahu, Hawaii
Tax Map Key: 4-2-62: Por. of 26

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2"SS-2" O.D. THIN WALL TUBE
2"SS-2" STANDARD SPLIT SPOON

BORING NO. 4 Sheet No. _____ of _____
Driller W. LUM ASSOC., INC. Date FEB. 21, 1973
Field Party MEYER, KAKU, OSHIRO
Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"
Elev. 193'± * Datum –
Drill Bit T.C. DRAG

Water Level	NOT NOTICED				
Time	–				
Date	2-21-73				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 193'± *	0									
(MH)	MEDIUM, REDDISH BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK		2"S	4-A	108	51	72	5730	–		5/0.5' 5/0.5' 7/0.5'
(MH)	MEDIUM, DARK BROWN CLAYEY SILT	5	2"SS	4-B	–	44	–	–	–		
						LL= 74					
						PL= 53					
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK	10	2"S	4-C	100	64	61	2170	–		3/0.5' 6/0.5'
(MH)	MEDIUM, MOTTLED REDDISH BROWN CLAYEY SILT	15	2"SS	4-D	–	63	–	–	–		
(MH)	STIFF MOTTLED REDDISH BROWN CLAYEY SILT	20	2"S	4-E	108	55	69	4290	–		7/0.5' 12/0.5'
	END OF BORING @ 21'										

* ELEVATION ESTIMATED FROM TOPO MAP

MAUNAWILI ESTATES

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Boring Log

PROJECT: MAUNAWILI ESTATES
LOCATION: Kailua, Koolaupoko, Oahu, Hawaii
Tax Map Key: 4-2-62: Por. of 26

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" SS - 2" O.D. THIN WALL TUBE
2" SS - 2" STANDARD SPLIT SPOON

BORING NO. 5 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC Date FEB. 21, 1973
Field Party MEYER, KAKU, OSHIRO
Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"
Elev. 247'± * Datum —
Drill Bit T.C. DRAG

Water Level	NOT NOTICED			
Time	11:00 AM			
Date	2-21-73			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV.=247'± *	0									
(MH)	STIFF, REDDISH BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK & ROOTS		2"SS	S-A	—	33	—	—	—		
MH	MEDIUM MOTTLED TAN BROWN CLAYEY SILT	5	2"S	S-B	111	54 LL= 67 PL= 51	72	2920	—		4/0.5' 6/0.5'
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT	10	2"SS	S-C	—	49 51	—	—	—		
(MH)	MEDIUM MOTTLED REDDISH BROWN CLAYEY SILT W/TRACES OF ROOTS	15	2"S	S-D	103	54	67	2970	—		4/0.5' 7/0.5'
(MH)	STIFF GRAY - BROWN W/BLACK CLAYEY SILT W/DECOMPOSED ROCK	20	2"SS	S-E	—	46	—	—	—		
	END OF BORING @ 21.5'										

* ELEVATION ESTIMATED FROM TOPO MAP

MAUNAWILI ESTATES

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	1	1	2	3
SAMPLE NO.		C	B (TOP)	C
DEPTH BELOW SURFACE	SURFACE	10'-11.5'	5'-6.5'	10'-11'
DESCRIPTION	BROWN CLAYEY SILT W/TRACES OF DECOMP. ROCK & ROOTS	MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMP. ROCK	RED & LIGHT BROWN CLAYEY SILT	REDDISH-BROWN SILTY CLAY
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1"	100			
1/2"	100			
#4	99.9			
#10	99.4			
#20	98.8			
#40	98.4			
#100	97.7			
#200	97.2			
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	95	79	90	108
Plastic Limit	63	61	56	55
Plasticity Index	32	18	34	53
Dilatancy	QUICK	QUICK	QUICK	MED.-QUICK
Toughness	SLIGHT-MED.	SLIGHT-MED.	SLIGHT-MED	MEDIUM
Dry Strength	MEDIUM	SLIGHT-MED	MEDIUM	MEDIUM
UNIFIED SOIL CLASSIFICATION	MH	MH	MH	MH
APPARENT SPECIFIC GRAVITY	2.89			
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %	43.0			
Molding Dry Density, P.C.F.	77.6			
Swell upon saturation, %	0.5			
CBR at 0.1" Penetration	6.6			
MOISTURE-DENSITY RELATIONS OF SOILS				
(AASHO T-180-57 Method ___)	A			
Dry to Wet or Wet to Dry	WET TO DRY			
Max. Dry Density (P.C.F.)	84.2			
Optimum Moisture (%)	35.5			

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 3-7-73 By BF

MAUNAWILI ESTATES

TABLE I B - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	4	5	5	
SAMPLE NO.	B		B	
DEPTH BELOW SURFACE	5'-6.5'	SURFACE	5'-6'	
DESCRIPTION	DARK BROWN CLAYEY SILT	REDDISH-BROWN CLAYEY SILT W/TRACES OF DECOMP. ROCK & ROOTS	MOTTLED TAN-BROWN CLAYEY SILT	
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"		100		
1/2"		100		
#4		100		
#10		100		
#20		99.9		
#40		99.7		
#100		98.3		
#200		96.8		
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	
Liquid Limit	74	72	67	
Plastic Limit	53	52	51	
Plasticity Index	21	20	16	
Dilatancy	QUICK	QUICK	QUICK	
Toughness	SLIGHT-MED.	SLIGHT-MED.	SLIGHT-MED.	
Dry Strength	SLIGHT-MED.	SLIGHT-MED.	SLIGHT-MED.	
UNIFIED SOIL CLASSIFICATION	MH	MH	MH	
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %		38.4		
Molding Dry Density, P.C.F.		82.4		
Swell upon saturation, %		9.2		
CBR at 0.1" Penetration		6.2		
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

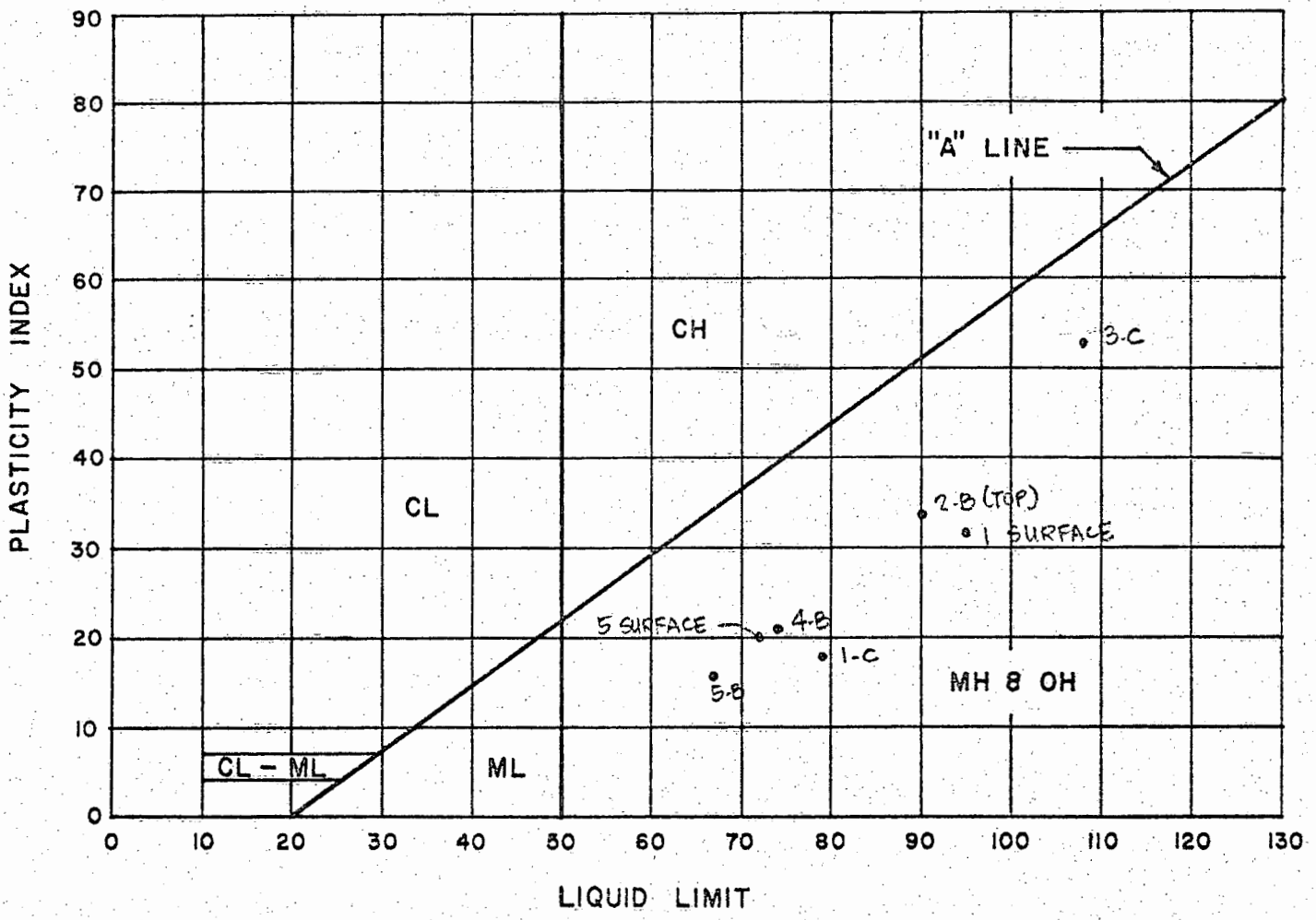
WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 3-7-73 By BT

PLASTICITY CHART

PROJECT: MAUNAWILI ESTATES

LOCATION: KAMAKALEPO, KAILUA, KOOLAUPOKO, OAHU, HAWAII



DATE 3-7-73 BY BT

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

8-872

MOISTURE–DENSITY CURVE (AASHO T-180-57, METHOD A)

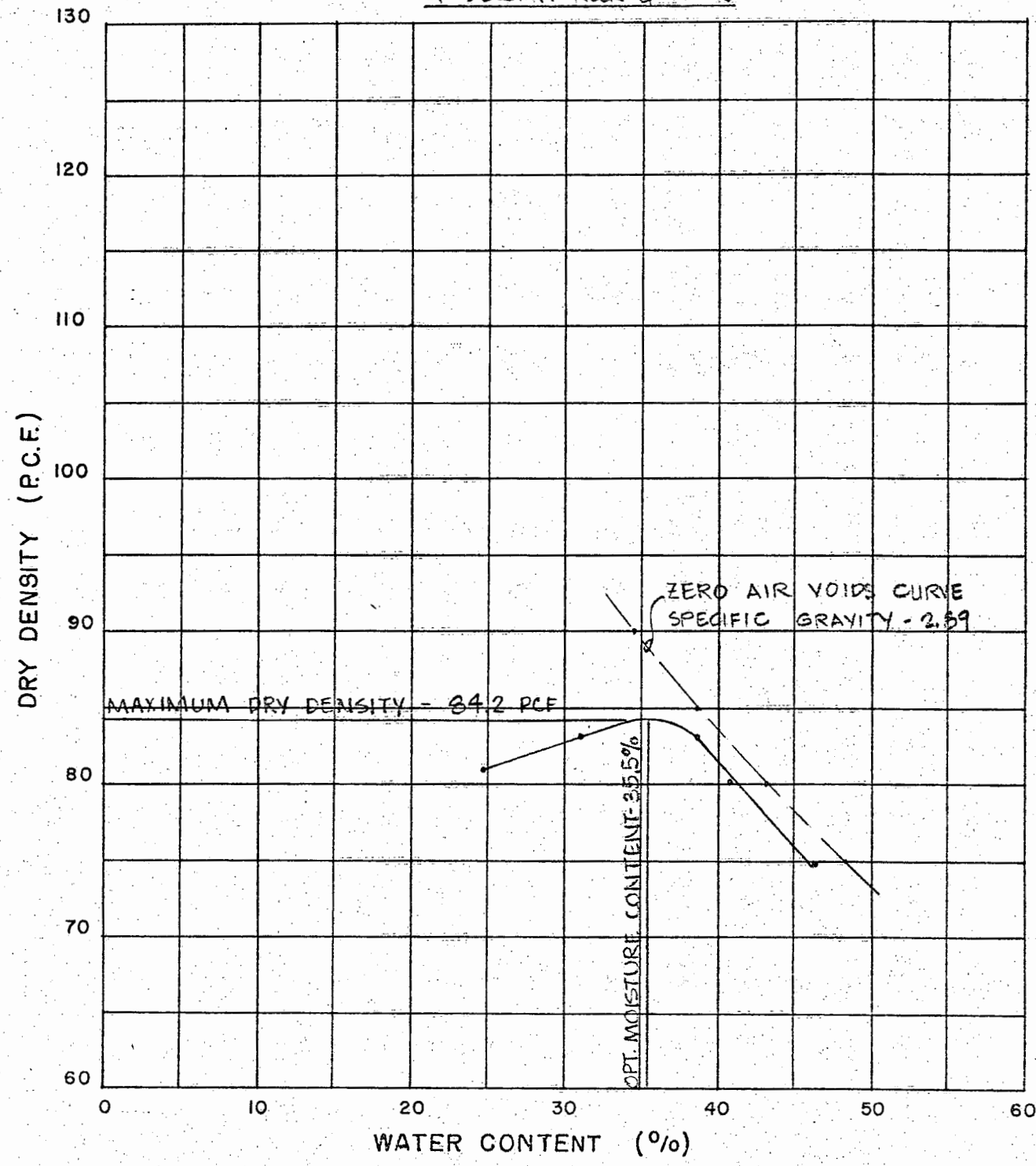
PROJECT: MAUNAWILI ESTATES

LOCATION: KAMAKALEPO, KAILUA, KOOLAUPOKO, OAHU

SAMPLE NO.: 1 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT W/TRACES OF DECOMP. ROCK & ROOTS

AGGREGATE: ¼" MINUS
MOLD SIZE: 4"Φ x 4.584" HIGH
HAMMER: 10 LBS 18" DROP
LAYERS: 5
BLOWS: 25/LAYER



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 3-6-73 BY NI

9-470

MOISTURE–DENSITY CURVE (AASHO T-180-57, METHOD A)

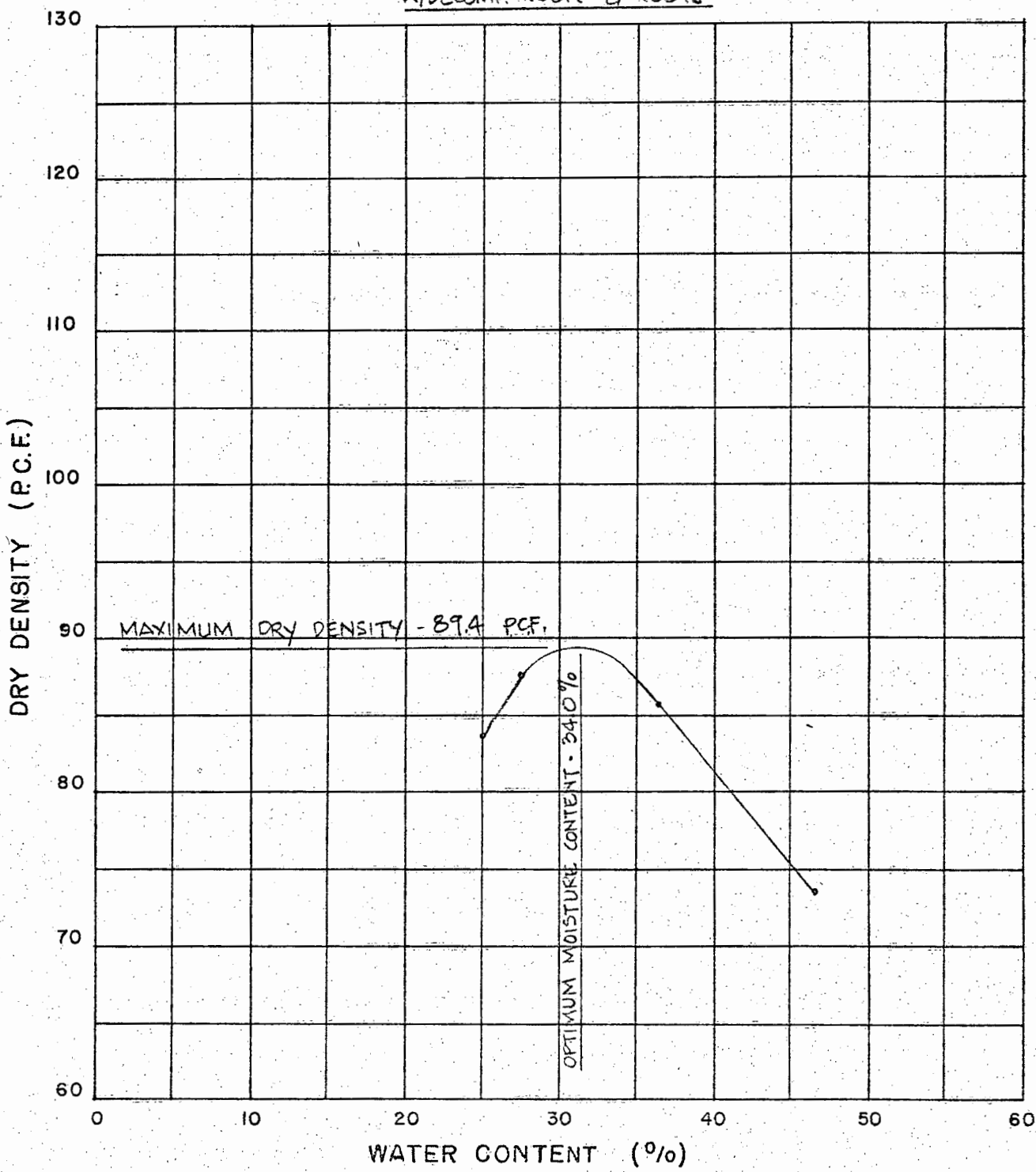
PROJECT: MAUNAWILI ESTATES

LOCATION: KAMAKALEPO, KAILUA, KOOLAUPOKO, OAHU

SAMPLE NO.: 5 SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN CLAYEY SILT W/DECOMP. ROCK & ROOTS

AGGREGATE: ¼" MINUS
MOLD SIZE: 4"Φ X 4.59" HIGH
HAMMER: 10 LBS 18" DROP
LAYERS: 5
BLOWS: 25/LAYER



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 3-7-13 BY BY

9-470

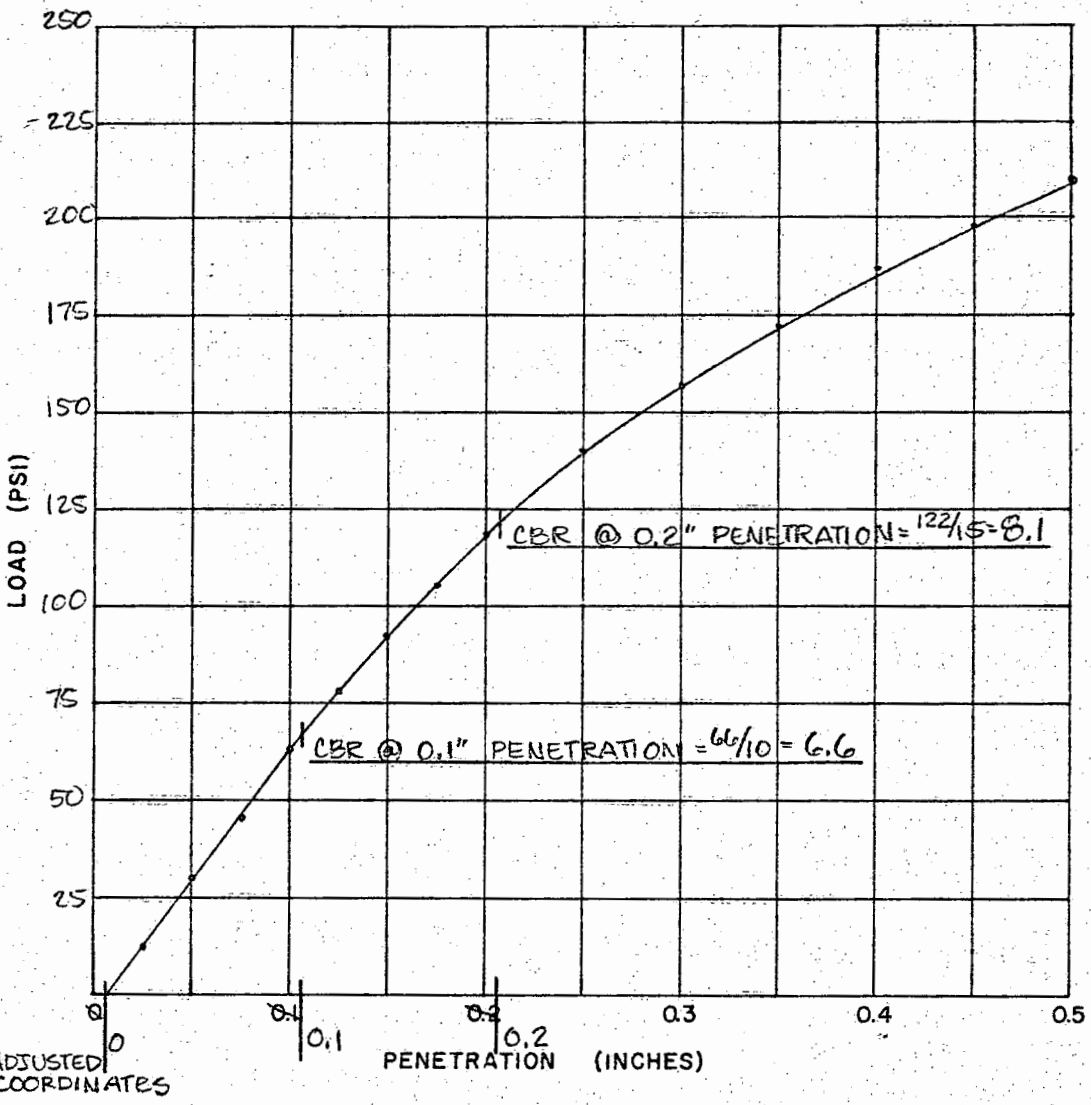
CBR TEST

PROJECT: MAUNAWILI ESTATES

LOCATION: KAMAKALEPO, KAILUA, KOOLAUPOKO, OAHU, HAWAII

SAMPLE NO: 1 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT W/TRACES OF DECOMP. ROCK & ROOTS



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	35	12
0.050	90	30
0.075	135	45
0.100	190	63
0.125	235	78
0.150	275	92
0.175	315	105
0.200	355	118
0.250	420	140
0.300	470	157
0.350	515	172
0.400	560	187
0.450	595	198
0.500	630	210

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS

HAMMER DROP 18"

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 43.0

MOLDING DRY DENSITY, P.C.F. 77.8

CBR @ 0.1" PENETRATION 6.6

DAYS SOAKED 4

DATE 3-5-73 BY TK & BS

DATE 3-6-73 BY NI

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

10-470

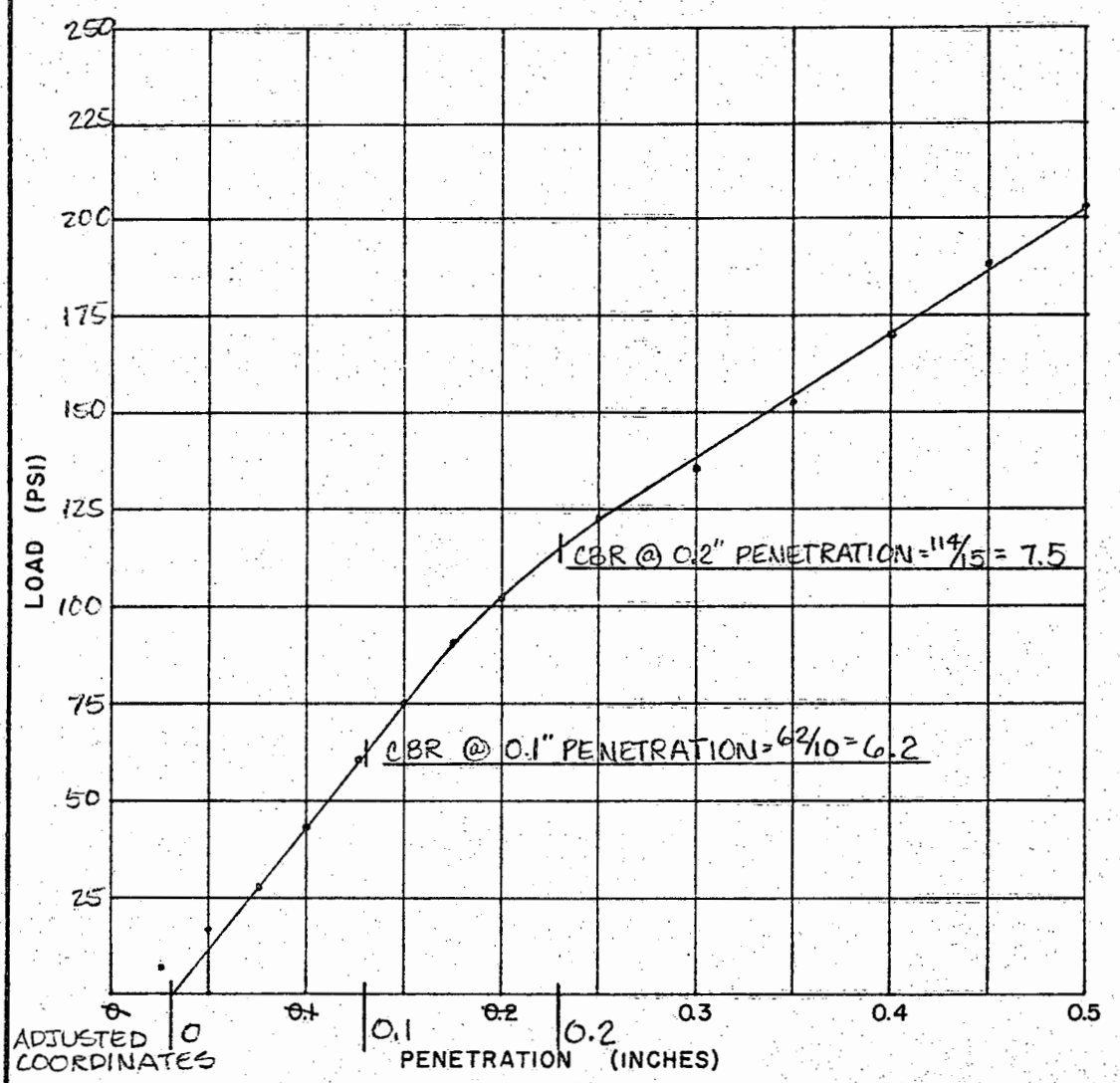
CBR TEST

PROJECT: MAUNAWILI ESTATES

LOCATION: KAMAKALEPO, KAILUA, KOOLAUPOKO, OAHU, HAWAII

SAMPLE NO: 5 SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN CLAYEY SILT W/TRACES OF DECOMP. ROCK & ROOTS



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	20	7
0.050	50	17
0.075	85	28
0.100	130	43
0.125	180	60
0.150	225	75
0.175	270	90
0.200	305	102
0.250	365	122
0.300	405	135
0.350	455	152
0.400	510	170
0.450	565	188
0.500	610	203

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS

HAMMER DROP 18"

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 38.4

MOLDING DRY DENSITY, P.C.F. 82.4

CBR @ 0.1" PENETRATION 6.2

DAYS SOAKED 4

DATE 3-5-73 BY TK & BS

DATE 3-6-73 BY NI

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

LAND COURT APPLICATION 754

NORTH
SCALE: 1" = 80'

B-1
B-2
B-3
B-4
B-5

15 10555 s.f. (.9320 ac.)
16 7825 s.f. (7990 s.f.)
17 5775 s.f.
18 5775 s.f.
19 5775 s.f.
20 5775 s.f.
21 5775 s.f.
22 6485 s.f.
23 7915 s.f.
24 6930 s.f. (6930 s.f.)
25 6940 s.f. (6940 s.f.)
26 6780 s.f. (6780 s.f.)
27 5940 s.f.
28 5940 s.f.
29 5940 s.f.
30 5810 s.f.
31 8760 s.f. (7040 s.f.)
32 7650 s.f.
33 15,420 s.f. (14,970 s.f.)
34 6160 s.f.
35 6000 s.f.
36 5920 s.f.
1 6030 s.f. (5705 s.f.) (4025 s.f.)
2 5280 s.f.
3 5139 s.f.
4 6555 s.f. (6555 s.f.) (6195 s.f.)
5 6555 s.f. (6555 s.f.) (6025 s.f.)
6 6555 s.f. (6555 s.f.) (5925 s.f.)
7 6555 s.f. (6555 s.f.) (6025 s.f.)
8 5780 s.f. (5415 s.f.) (5925 s.f.)
9 6555 s.f. (6555 s.f.) (6195 s.f.)
10 5555 s.f.
11 5555 s.f.
12 5555 s.f.
13 9200 s.f.
14 9210 s.f. (7420 s.f.) (5400 s.f.)

(10 ft. wide) DRAINLINE EASEMENT
32 ft. ROADWAY
(15 ft. wide) SWALE EASEMENT
KIKA STREET
ALOHA DRIVE
MAUNAWILI ESTATES
OMAO STREAM
209-B-2
209-B-

LEGEND

- BORING
- SUBDRAIN
- LATERAL SUBDRAIN

BORING LOCATION SKETCH
MAUNAWILI ESTATES
KAMAKALEPO, KAILUA, KOOLAUPOKO, OAHU, HAWAII
TAX MAP KEY: 4-2-62: POR. OF 26

Dr.	WALTER LUM ASSOCIATES, INC.	Sheet
Date 3/13	3030 WAIALAE AVE.	
Rev.	CIVIL ENGINEERS	of
	PHONE 737-7931	

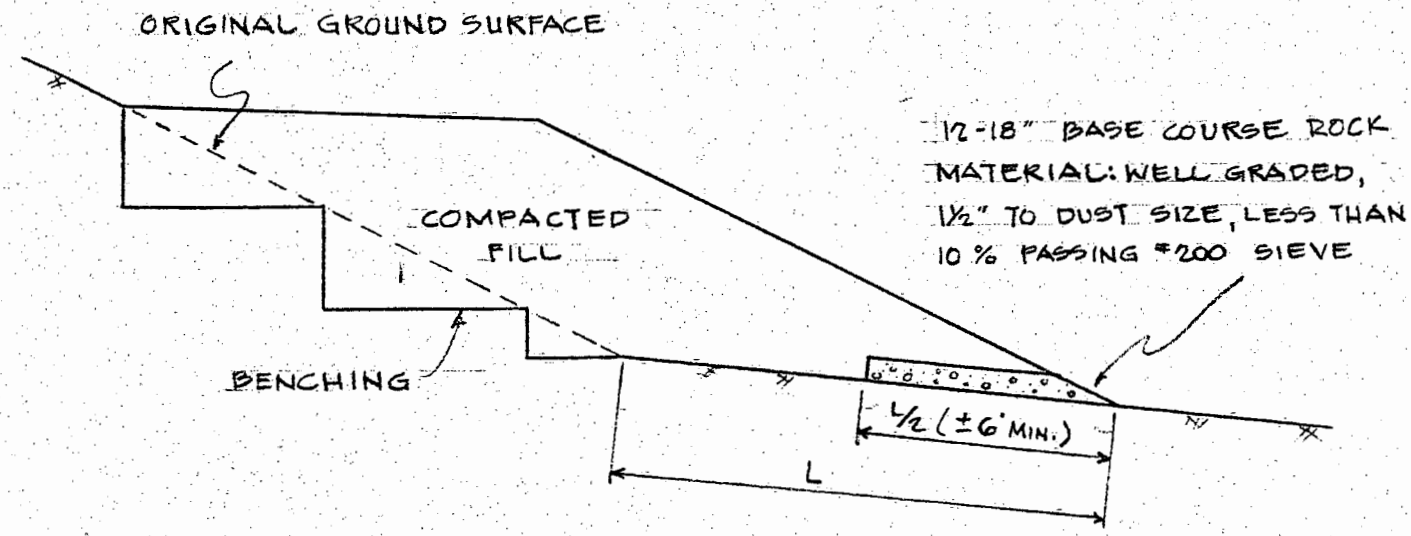


FIGURE 1

PROPOSED SLOPE ADJUSTMENT FOR SLIVER FILLS

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

LIMITATIONS

In general, soil formations are commonly erratic and rarely uniform or regular. The boring logs indicate the approximate subsurface soil conditions encountered only at the drill holes where the borings were made at the times designated on the logs and may not represent conditions at other locations or at other dates. Soil conditions and water levels may change with the passage of time and construction methods or improvements at the site.

During construction, should subsurface conditions much different from those in the borings be observed, encountered, or otherwise indicated, we should be advised immediately to review or reconsider our recommendations in light of the new developments.

If there is a substantial lapse of time between the submission of this report and the start of work at the site, or if conditions have changed due to natural causes, plan changes, or construction operations at or adjacent to the site, it is recommended that this report be reviewed to determine the applicability of the recommendations considering the time lapse and the changed conditions.

Our professional services were performed, findings obtained and recommendations prepared in accordance with generally accepted engineering practices. This warranty is in lieu of all other warranties expressed or implied.